Weather Literacy: Assessing Third-Grade Students' Knowledge and Skills related to weather

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Abstract. Weather literacy is highly important and closely intertwined with everyday life. Our knowledge regarding the weather comprehension of third-graders and their ability to interpret weather patterns still needs to be improved. The findings of this study revealed that students better understand precipitation and temperature yet need to show greater comprehension of cloud cover and wind patterns. Furthermore, interpreting combinations of weather elements and phenomena proved more challenging. The implications of these findings prompt considerations on how weather literacy is cultivated within school curricula, strategies for managing hazardous weather situations, assessing the weather's impact on students to mitigate potential risks.

Introduction

The escalating impact of anthropogenic climate change has heightened concerns regarding hazardous weather events, particularly noticeable in Northern Europe, including Estonia, where heatwaves and heavy rains have increased [1]. Despite the abundance of weather-related information available, gaps persist in understanding people's knowledge, especially among children [2]. Recognising the significance of climate literacy, the National Oceanic and Atmospheric Administration (NOAA) of the United States underscores its importance within scientific literacy, highlighting the intricate interplay between human activities and climate dynamics [3]. Thus, weather literacy emerges as a crucial component of climate literacy.

Theoretical framework

Weather literacy encompasses the ability to observe, comprehend, and articulate weather phenomena using scientific methods while fostering an appreciation for nature. However, not all weather elements are comprehended equally and predicted outcomes may not always align with actual effects, particularly during extreme weather occurrences. For instance, research by Fleischhut et al. [4] indicates that weather risks often need to be more accurately assessed, with a failure to connect them to specific extreme values of weather elements such as thunderstorms, heatwaves, slippery roads, strong winds, or rain.
This study aimed to gather data and assess the weather-related knowledge and skills of third-grade students. Two research questions were posed:
What weather elements pose greater difficulty for third graders to grasp?
From which sources and in what manner do third graders find it easier to comprehend information about the weather?

Methods and findings

732 third-grade students from 32 schools in Estonia participated in the study, which aimed to assess their weather knowledge using the Meteorological Knowledge Test. Tailored for third-grade students, this test covers various everyday weather topics, such as precipitation, wind, cloud cover, and temperature, presented in multiple contexts. Tasks within the test require students to comprehend weather forecasts, observe current weather conditions, draw conclusions, and make real-life decisions.

In tasks A and D, students are required to analyse weather forecasts and assess the immediate weather conditions, including making practical decisions. Tasks B and C involve observing current weather conditions and drawing conclusions based on these observations.

Table 1 The task results, organised by weather elements and data presentation methods, are represented as relative values.

	All tasks	Temperature	Cloudiness	Precipitations	Wind	Combined	Task A	Task B	Task C	Task D
Mean	0.64	0.72	0.64	0.73	0.59	0.58	0.70	0.65	0.68	0.55
SD	0.20	0.19	0.26	0.22	0.23	0.29	0.16	0.24	0.28	0.37
Max	0.90	1.00	0.96	1.00	0.89	0.93	0.94	0.94	0.96	0.93
Min	0.10	0.15	0.00	0.17	0.07	0.00	0.18	0.00	0.00	0.00
Max of task	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Temperature and precipitation emerged as the most easily understood weather elements among students. Conversely, questions pertaining to wind and cloudiness proved to be more challenging (Table 1). Students demonstrated proficiency in identifying the highest and lowest temperature values, as well as in comparing numerical values and determining temperature fluctuations over time. However, they struggled with questions involving concepts commonly used in forecasts but unfamiliar to them, such as perceived temperature or cloudy weather. While students exhibited a strong ability to recognise different types of clouds, they encountered difficulty in providing reasoning to identify them as rain clouds. The lowest student performance was observed in questions combining multiple weather elements.

Conclusion

Effective management of dangerous situations and accurate observations necessitate a sound understanding of weather phenomena. The research unveiled that questions involving multiple weather elements or phenomena, referred to as combined questions, pose challenges for students in finding the correct answers, as they require establishing and analysing connections at a higher cognitive level [5]. The study revealed that the comprehension level is influenced by the manner in which the forecast is presented.

In conclusion, based on the study's findings, it is recommended to focus on addressing dangerous weather situations with students, evaluating the weather's impact on individuals and the surrounding environment to better grasp potential associated risks.

References

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